

Missouri Department of Natural Resources

Total Maximum Daily Load Information Sheet

Shaw Branch

Waterbody Segment at a Glance:

County: St. Francois
Nearby Cities: Elvins
Length of impairment: 2 miles
Pollutant: Nonvolatile Suspended Solids (NVSS) and lead
Source: Federal Abandoned Mine Land



State map showing location of watershed

Note: Proposed to change the pollutant from sediment to NFR on the 2002 303(d) list.

TMDL Priority Ranking: High

Description of the Problem

Beneficial uses of Shaw Branch

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life and Human Health associated with Fish Consumption.

Use that is impaired

- Protection of Warm Water Aquatic Life

Standards that apply

- Standards for non-filterable residue (NFR) may be found in the general criteria section of the Water Quality Standards, 10 CSR 20-7.031(3)(A), (C) and (G) where it states:
 - Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses.
 - Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses.
 - Waters shall be free from physical, chemical or hydrologic changes that would impair the natural biological community.
- Missouri Water Quality Standards for metals found in 10 CSR 20-7.031(4)(B)1 state:
 - Water contaminants shall not cause the criteria in Tables A and B to be exceeded. Concentrations of these substances in bottom sediments or waters shall not harm benthic organisms and shall not accumulate through the food chain in harmful concentrations, nor shall state and federal maximum fish tissue levels for fish consumption be exceeded.

- The numeric standards for lead are found in Table A. These standards are dependent on the hardness of the water. The lead standard that applies in these waterbodies is 23 micrograms per liter ($\mu\text{g/L}$) at a hardness of over 200.

The impairment is being changed for the new 303(d) list from sediment to Non-Volatile Suspended Solids (NVSS). NVSS results from soil erosion or erosion of mine waste materials or stockpiles (usually silt, sand or gravel). The new listing gives a clearer picture of the specific pollutants affecting the water.

The impaired portion of Shaw Branch is located in the “Old Lead Belt” region of southeast Missouri. Philip Francois Renault’s mining company discovered lead ore in the area as early as 1720. For more than 100 years, this area produced nearly 80 percent of the nation’s mined lead. The St. Joe Lead Company acquired the site in 1864. In 1869 the use of the diamond-tipped drill allowed mining of lead ore deep underground and led to rapid development of the area. By 1900, the St. Joe Lead Co. was the nation’s largest lead producer due to their acquisition of smaller lead companies, including the Federal Lead Company mine site causing the impairment to Shaw Branch. In 1972, St. Joe Minerals Corp. stopped production of lead at the site. The mining complex, along with 8,000 acres of land, was donated to the state in 1976 to be used for recreational purposes. The Federal Mill Complex was developed as the Missouri Mines State Historical Site, and includes large mining equipment and mine buildings.

Letterbooks from the Federal Lead Company indicate environmental pollution was a concern prior to 1913. During the time the letterbooks were kept, 1907-1913, farmers and ranchers along Big River brought a suit against the Federal Lead Company. The suit claimed that lead pollution had harmed or destroyed crops and herds. By the ending date of the letterbooks, the suit had not been resolved.¹

Decades of erosion of the Federal tailings pile, now contained within St. Joe State Park, has resulted in so much sediment being deposited in Shaw Branch that the stream has been completely buried in tailings and no longer provides any aquatic habitat. During stormwater runoff, some of these tailings also enter Flat River Creek and Big River, filling pools in those streams. This sediment (or nonvolatile suspended solids) reduces the aquatic habitat quality in these streams by smothering natural substrates (materials in the streambed). Aquatic invertebrate animals (water insects and crayfish) and fish eggs are also smothered. A map of the area and a data table are found below.

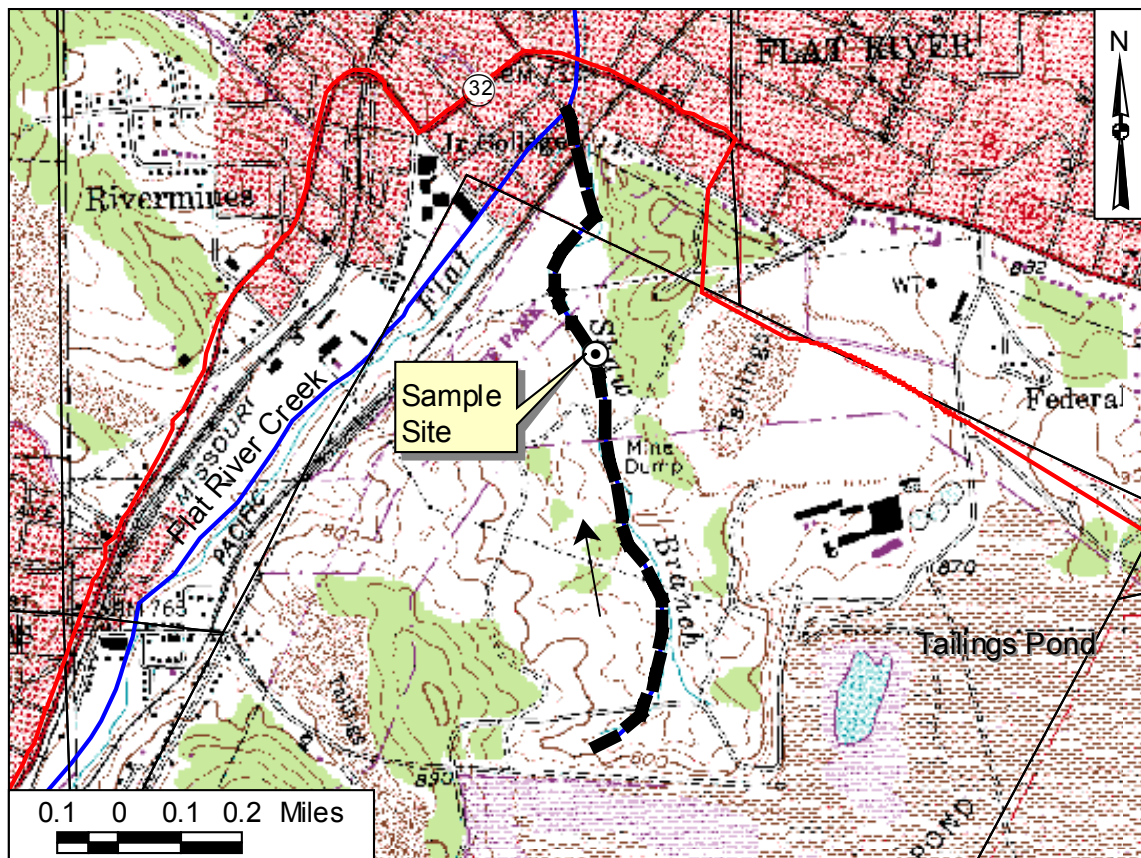
Fish and other aquatic life have accumulated elevated levels of lead in their bodies due to dissolved lead draining from the old tailings. Shaw Branch is a tributary of Flat River Creek, which in turn runs into Big River. These two waterbodies are also on the 303(d) list for lead and zinc pollution and nonvolatile suspended solids, and presently are under a Missouri Department of Health Advisory recommending no consumption of sunfish, carp or suckers due to lead contamination of these fish. In humans, lead primarily affects the nervous system, blood cells, and processes for the metabolism of Vitamin D and calcium. Lead can affect the developing fetus during pregnancy and cause lower IQ scores, poor attention levels; hearing, speech and language problems; reading disabilities; reduced motor skills and poor hand-eye coordination. Evidence suggests that lead toxicity may occur at levels as low as 10-15 micrograms per deciliter ($\mu\text{g/dL}$) of blood. According

¹ University of Missouri at Rolla Web site, R520 – Federal Lead Company, Mining Dept. (Flat River, MO.), Letterbooks, 1907-1913 – Information Sheet. www.umsr.edu/~whmcinfo/shelf21/r520/info.html

to the Missouri Department of Health and Senior Services, 11% of the children in St. Francois County tested for blood lead levels actually have lead poisoning.

Zinc is readily transported in most natural waters and is one of the most mobile of the heavy metals. Hardness, dissolved oxygen, temperature and synergistic (more than the sum of the individual components) effects with other compounds all affect the toxicity of zinc to aquatic life². Zinc is an essential nutrient to aquatic and terrestrial organisms, but in excess can be highly toxic and has the tendency to bioaccumulate (build up in organisms) in the environment. A number of behavioral and physiological effects have been reported when test organisms have been exposed to increased zinc levels. Behavioral responses in fish include avoidance and changes in feeding rate and movement patterns. Physiological changes in fish include increased ventilation rates, frequency of coughing and a decrease in oxygen utilization.³

Impaired Segment of Shaw Branch in St. Francois County, Missouri, with Sampling Site



--- Impaired Segment → Direction of flow

² Upper Sacramento River TMDL for Metals, California Environmental Protection Agency, 9/25/01.

www.swrcb.ca.gov/rwqcb5/TMDL/upperSacCdCuZn.html

³ Red Clay Creek TMDL, Delaware Natural Resources and Environmental Control, 8/1/99.

www.dnrec.state.de.us/DNREC2000/Library/Water/rctmdl.pdf

Non-Filterable Residue and Dissolved Lead in Shaw Branch, 1997-2000

Date	Flow (cu ft/sec)	Non-filterable residue (mg/L)	Dissolved Lead (µg/L)
April, 1997	0.01	18.4	2.499
June, 1997	0.31	53	11
July, 1997	0.27	1.2	23
October, 1997	0.04	16.4	7.1
March, 1998	26.78	260	50.3
June, 1998	0.07	105	13.9
July, 1998	0.01	4.4	6.6
March, 1999	0.08	93	24.3
March, 2000	0.67	61	15.8
July, 2000	0.8	51	14.499

Source: Missouri Department of Natural Resources, Division of Parks and Historic Places

For more information call or write:

Missouri Department of Natural Resources

Water Pollution Control Program

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